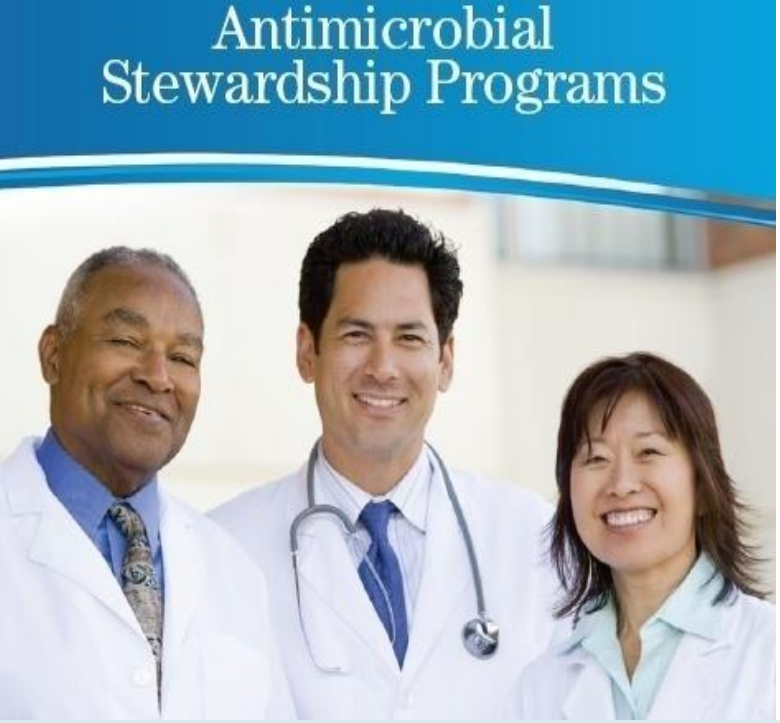


Antimicrobial Stewardship:

Arizona Partnerships Working to Improve the Use of Antimicrobials in the Hospital and Community

Part 3

"Antibacterials – indeed, anti-infectives as a whole – are unique in that misuse of these agents can have a negative effect on society at large. Misuse of antibacterials has led to the development of bacterial resistance, whereas misuse of a cardiovascular drug harms only the one patient, not causing a societal consequence."

- Glenn Tillotson; Clin Infect Dis. 2010;51:752

"…we hold closely the principles that antibiotics are a gift to us from prior generations and that we have a moral obligation to ensure that this global treasure is available for our children and future generations."

- David Gilbert, et al (and the Infectious Diseases Society of America). Clin Infect Dis. 2010;51:754-5

A Note To Our Readers and Slide Presenters

The objectives of the Subcommittee on Antimicrobial Stewardship Programs are directed at education, presentation, and identification of resources for clinicians to create toolkits of strategies that will assist clinicians with understanding, implementing, measuring, and maintaining antimicrobial stewardship programs.

The slide compendium was developed by the Subcommittee on Antimicrobial Stewardship Programs (ASP) of the Arizona Healthcare-Associated Infection (HAI) Advisory Committee in 2012-2013.

ASP is a multidisciplinary committee representing various healthcare disciplines working to define and provide guidance for establishing and maintaining an antimicrobial stewardship programs within acute care and long-term care institutions and in the community.

Their work was guided by the best available evidence at the time although the subject matter encompassed thousands of references. Accordingly, the Subcommittee selectively used examples from the published literature to provide guidance and evidenced-based criteria regarding antimicrobial stewardship. The slide compendium reflects consensus on criteria which the HAI Advisory Committee deems to represent prudent practice.

Disclaimers

All scientific and technical material included in the slide compendium applied rigorous scientific standards and peer review by the Subcommittee on Antimicrobial Stewardship Programs to ensure the accuracy and reliability of the data. The Subcommittee reviewed hundreds of published studies for the purposes of defining antimicrobial stewardship for Arizonan clinicians. The Arizona Department of Health Services (ADHS) and members of its subcommittees assume no responsibility for the opinions and interpretations of the data from published studies selected for inclusion in the slide compendium.

ADHS routinely seeks the input of highly qualified peer reviewers on the propriety, accuracy, completeness, and quality (including objectivity, utility, and integrity) of its materials. Although the specific application of peer review throughout the scientific process may vary, the overall goal is to obtain an objective evaluation of scientific information from its fellow scientists, consultants, and Committees.

Please credit ADHS for development of its slides and other tools. Please provide a link to the ADHS website when these material are used.

Introduction to Slide Section

- **Preface:**

  So how do you convince hospital administration to fund an ASP, provide compensation to a physician champion, tell prescribers that their antimicrobial orders will be monitored, and reorganize pharmacist functions to devote sufficient time for achieving the proposed goals and objectives of the ASP?

- **Content:**

  28 slides; 3 back-up slides.

- **Suggestions for Presentation:**

  Due to the nature of this section many users will find this material educational rather than for presentation to a large audience. However, the clinical examples presented can be used to make a case for support and implementation of an ASP.

- **Comments:**

  There are 10 examples which can be used the “make the case”. Importantly, not all of these examples provide a cost benefit back to the pharmacy budget but rather focus on patient outcomes. The “bigger picture” is consistent with providing optimal patient care and using antimicrobials wisely. Several examples of accountabilities are provided in slide #3 which can be included as either short-term or long-term objectives. Costs could be calculated for many of these potential interventions. But do not over-promise! Business planning is also introduced.

ANTIMICROBIAL STEWARDSHIP: MAKING THE CASE

Formulary Management Versus Patient-Centric Program: Can Both Be Accomplished Simultaneously?

- Pre-prescription review may restrict expensive agents through enforcement of empiric antibiotic guidelines based on the antibiogram
- Post-prescription review may focus on expensive agents or commonly overused antibiotics
  - Study of over-used antibiotics, albeit lower cost, such as vancomycin
  - Study of specific disease states, such as bacteremia, asymptomatic bacteriuria, or community-acquired pneumonia
  - Assesses antibiotic when C&S results are most commonly available
  - Allows for assessment of IV-to-PO conversion and other de-escalation opportunities
- Disease-specific objectives can be challenging but are aligned more closely with clinical outcomes
  - Studying the effect of an ASP on the improvement of clinical outcomes requires a focus on key objectives
- Focus on formulary management as the sole objective limits the ASP to controlling drug costs, and clinical outcomes may be largely ignored
  - A patient-centric ASP uses evidence-based guidelines to improve clinical outcomes and manage drug costs

Accountabilities of the Antimicrobial Stewardship Team: Elements For a Business Model (Examples)

- Decrease antibiotic budget by 20% each year for 2 consecutive years
- Increase physician and pharmacist knowledge about bacterial resistance and appropriate antibiotic use as assessed by annual survey and examination
- Specific intervention goals of the ASP (i.e., over first 2 years)
  - Decrease duration of IV ABX therapy by 30%
  - Increase IV-to-PO sequential therapy by 50%
  - Create pathways/guidelines for 80% of all infection-related hospitalizations
  - Decrease re-admission rates for community-acquired pneumonia by 50%
  - Decrease number of patients receiving ≥ 3 ABXs by 50%
  - Eliminate duplicative therapy with selected broad-spectrum agents
  - Increase appropriate antibiotic therapy for BSIs within 24 hrs of +BC to 100%
  - Increase de-escalation (C&S results) by 80% for targeted antibiotics
  - Decrease vancomycin use > 3 days by 30%
  - Eliminate vancomycin therapy for blood culture contamination

But …. don't promise what you can't deliver

Don’t Promise What You Cannot Deliver

- Decreased bacterial resistance
  - Limited evidence from single-centered studies frequently with inadequate study periods
  - Resistance may improve for one class of agents but worsen for another – is this progress?
  - Do not promise this, but it may be an outcome of ASP activities
  - No studies have defined what degree of decreased antibiotic pressure will result in decreased resistance with any specific MDRO
  - Use of complex time series analysis requires trends over many years
- Decreased *Clostridium difficile* infection
  - Difficult to achieve with antibiotic stewardship alone
  - Requires intensive changes in environmental decontamination, patient isolation procedures, and hand hygiene
- Cost-savings which are unlikely
  - Read literature on ASPs to find institutions which are similar – how much did they save and how were their ASPs managed
  - Go slow, target low-hanging fruit, and focus on interventions which will likely produce a substantial cost-savings

The Cost of HAIs Is Significant, But Lower HAI Rates Is Not a Promise To Be Made

- The Centers for Disease Control and Prevention (CDC) estimates that 1.7 million patients contract healthcare-associated infections every year and nearly 99,000 of them die [1,3,4]
  - HAIs are estimated to be one of the top 10 causes of death in the US
- The annual direct medical costs of HAIs to hospitals range from $28.4 to $33.8 billion [2,3,4]
  - A study of 1.7 million hospitalized patients discharged from 77 hospitals found that the additional cost of treating a HAI averaged $8,832
- In Pennsylvania, 23,287 (1.2%) hospital-admitted patients contracted at least one HAI during their stay[5]
  - Mortality: 9.4% (HAI) vs 1.8% (no HAI)
  - Average LOS: 21.6 days (HAI) vs 4.9 days (no HAI)
  - Estimated Medicare payments: $20,471 (HAI) vs $6,615 (no HAI)
  - Readmission within 30 days (infection/complication): 29.8% (HAI) vs 6.2% (no HAI)

While every effort should be made to decrease HAIs, ASPs may directly impact rates of *C. difficile* infection and surgical site infections

1 Klevens R, et al. Estimating health care-associated infections and deaths in U.S. hospitals, 2002. Public Health Reports. 2007;122:160-166 .
2 Scott, RD. The direct medical costs of healthcare-associated infections in U.S. hospitals and the benefits of prevention, 2009. Division of Healthcare Quality Promotion, National Center for Preparedness, Detection, and Control of Infectious Diseases, Coordinating Center for Infectious Diseases, Centers for Disease Control and Prevention, 2009.
3 GAO Report; April 16, 2008; GAO-08-283; HHS Action Plan to Prevent HAIs; released Jan 6, 2009 .
4 http://www.ihi.org/IHI/Programs/Campaign/Campaign.htm?TabId=2#InterventionMaterials
5 The Pennsylvania Department of Health. (2010). Healthcare-associated infections (HAI) in Pennsylvania hospitals – 2009 (technical report).

Approximated Cost-Savings Can Be Estimated For Your Business Model – Look For Opportunities

- IV-to-PO switch
  - If the average change in decreasing duration of therapy of 5 common IV antibiotics through conversion to orals is 3 days, and the ASP could intervene on 70% of these regimens, how many days of therapy could be saved?
- Pharmacodynamic dose optimization , e.g., dosing of IV beta-lactams (for susceptible pathogens)
  - Cefepime 2 grams IV Q8H → 1 gram IV Q6H
  - Piperacillin-tazobactam 4.5 grams IV Q6H (doses over 20 mins) converted to piperacillin-tazobactam 4.5 grams IV Q8H (doses over 4 hours)
- Discontinue duplicate therapy
  - How often is metronidazole combined with piperacillin-tazobactam or a carbapenem? Perform an audit, then estimate costs of discontinued metronidazole
- Pathogen-directed therapy based on results of C&S
  - What is baseline de-escalation rate within 48 hours following availability of C&S results? What cost-savings could be associated with a 30% improvement (increase in de-escalation)?
- Assess potential to change antibiotic prescription habits
  - Acute uncomplicated cystitis, e.g., shorter duration and use of preferred agents

Owens R. Diag Microbiol Infect Dis. 2008;61:110-28.

Several Resources of ASP Business Plans

- Page 4 of 5 of CDC template for an ASP business plan

Outcome Measurements

The success of this proposal depends on the regular monitoring and evaluation of the outcomes of interest, namely the impact of these activities on antibiotic use, antibiotic resistance, and cost savings. An annual report will be provided summarizing these outcome measurements.

Intervention	*Potential Cost Savings*	*Clinical and Microbiologic Outcomes*
Antibiotic Approvals		• Improved appropriateness of antibiotic suggestions[5] • Improved infection cure rate[5]
Post-prescribing Review • **IV to PO Conversions** • **Decrease Antibiotic Duration** • **Duplicate Therapy** • **Pharmacokinetics** • **De-escalation/ Streamlining**	**$ 103,000** **$ 242,000**	• Decrease in antibiotic-related adverse drug events • Decrease in median length of stay by up to 3 days[5,7,8] • Decrease in antibiotic resistance[2,9,10]
Surveillance of Antibiotic Resistance and Utilization		• Decrease in inappropriate antibiotic utilization • Decrease in antibiotic resistance
Total potential measurable cost savings	**$ 345,000 ***	
2 Additional FTE's (ID Clinical Pharmacy Specialists)	**$ 180,000 ****	
NET POTENTIAL MEASURABLE COST SAVINGS	**$ 165,000**	

* additional cost savings can be achieved by LOS reductions, safety, resistance, and patient outcomes over time

** excludes benefits

Available at: http://www.cdc.gov/getsmart/healthcare/improve-efforts/tools.html (accessed Oct 30, 2013)

Business Plan Elements for ASP Justification: Specifics Are Important and Negotiable

- The longitudinal evaluation to quantify cost-savings is influential because the data is collected from and pertains to the specific health care facility
  - Obtain data on the rate of a specific infection, propose a change in management, study the potential effects of instituting the change, apply cost-savings (calculated by multiplying the amount of decrease in the infection rate by the published cost of each occurrence of the infection)
- A presentation to administration to negotiate an ASP should consist of:

Internal preparation (what are the direct needs of the ASP)	• Identify, list, and understand the costs, organized into present costs, costs of inaction, and costs of definitive action • Structure a best alternative to negotiating an agreement (BATNA) • Establish a global fee for ID physician role based on proposed hours/week
External preparation (what are the needs of the hospital)	• Evaluate past obstructions • What is the hospital's BATNA • Establish fair market value (FMV)

McQuillen D et al. Clin Infect Dis. 2008;47:1051-63 (description of a BATNA, pp. 1057)
Perencevich E, et al. Infect Control Hosp Epidemiol. 2007;28:1121-33.

Antimicrobial Stewardship: IDSA/SHEA Guideline

Infectious Diseases Society of America and the Society for Healthcare Epidemiology of America Guidelines for Developing an Institutional Program to Enhance Antimicrobial Stewardship

Timothy H. Dellit,[1] Robert C. Owens,[2] John E. McGowan, Jr.,[3] Dale N. Gerding,[4] Robert A. Weinstein,[5] John P. Burke,[6] W. Charles Huskins,[7] David L. Paterson,[8] Neil O. Fishman,[9] Christopher F. Carpenter,[10] P. J. Brennan,[9] Marianne Billeter,[11] and Thomas M. Hooton[12]

[1]Harborview Medical Center and the University of Washington, Seattle; [2]Maine Medical Center, Portland; [3]Emory University, Atlanta, Georgia; [4]Hines Veterans Affairs Hospital and Loyola University Stritch School of Medicine, Hines, and [5]Stroger (Cook County) Hospital and Rush University Medical Center, Chicago, Illinois; [6]University of Utah, Salt Lake City; [7]Mayo Clinic College of Medicine, Rochester, Minnesota; [8]University of Pittsburgh Medical Center, Pittsburgh, and [9]University of Pennsylvania, Philadelphia, Pennsylvania; [10]William Beaumont Hospital, Royal Oak, Michigan; [11]Ochsner Health System, New Orleans, Louisiana; and [12]University of Miami, Miami, Florida

"Effective antimicrobial stewardship programs can be financially self-supporting and improve patient care. Comprehensive programs have consistently demonstrated a decrease in antimicrobial use (22%–36%), with annual savings of $200,000–$900,000 in both larger academic hospitals and smaller community hospitals"

Dellit TH, et al. Clin Infect Dis. 2007;44:159-77.

Impact of Antibiotic Stewardship Programs

Hospital Size	Participation by Clinicians					Antimicrobial Cost Savings	Drug Resistance & Infectious Diseases Outcomes
	ID MD	Clin RX	Micro	Data Analyst	IP/IC		
174 beds	x	x				Annual cost reduction: $200,000-$250,000	Reduced rate of nosocomial *Clostridium difficile* and MDR-*Enterobacteriaceae*
250 beds	x	x	x	x		Cost-savings during 18 month study: $913,236	Decreased resistance rates
650 beds	x	x			x	Net savings for 1 year: $189,318	Reduced rate of VRE colonization and bloodstream infections
120 beds	x	x	x		x	19% decrease ABX costs/pt; annual cost reduction: $177,000	Not reported

McQuillen D, et al. Clin Infect Dis.2008;47:1051-63

Example #1: Guideline-Concordant Therapy in Community-Acquired Pneumonia (CAP) Improves Outcomes

- 1,649 patients, ≥ 65 years of age, hospitalized with CAP (2001-2007); 43 centers; 12 countries
- Initial empiric therapy for CAP was evaluated for guideline compliance according to the 2007 IDSA/ATS guidelines (59% adherent, 41% non-adherent)

Measure	Adherent	Non-Adherent
Clinical stability by 7 days*	71% (95% CI, 68%-74%)	57% (95% CI, 53%-61%)
Median length of stay*	8 days (IQR, 5-15 days)	10 days (IQR, 6-24 days)
In-hospital mortality*	8% (95% CI, 7%-10%)	17% (95% CI, 14%-21%)

* $P<0.01$

An ASP structured to strengthen compliance with treatment guidelines may impact patient outcomes and length of stay

Arnold F et al. Arch Int Med. 2009;169(16):1515-24

Example #2: ASP Plus Automated Pharmacy Technology Improve Antimicrobial Appropriateness for CAP

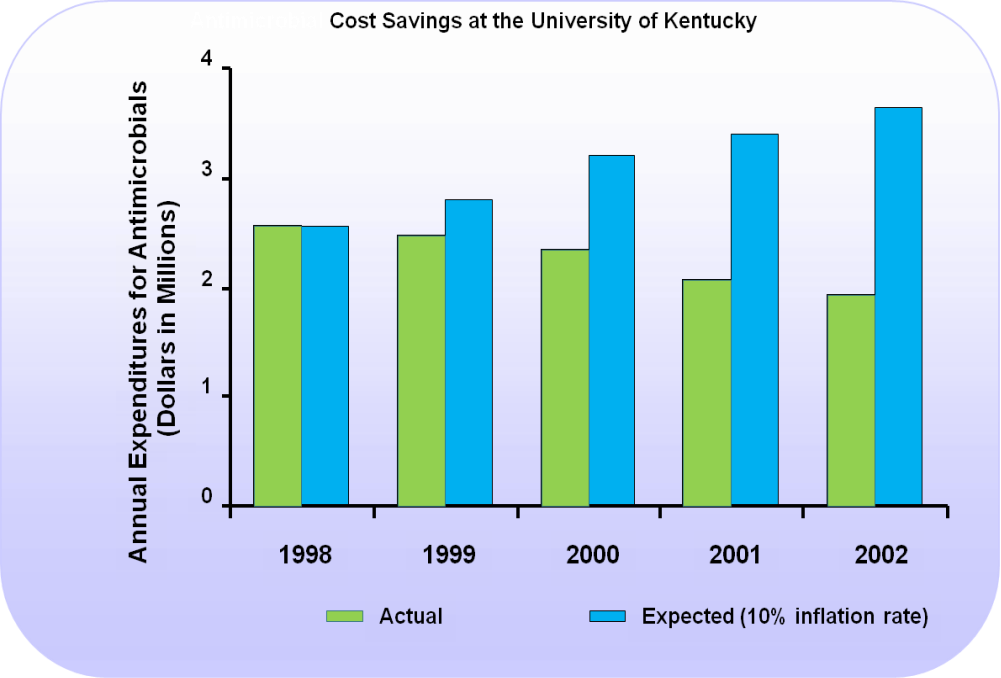
- A multidisciplinary committee sought to optimize initial selection of antibiotics for adult CAP as a CMS performance measure
- A large urban multi-campus academic medical center developed several tools in the emergency department
  - Algorithm for ED providers identifying appropriate antibiotic selections
  - Development of a CAP Toolkit consisting of appropriate antibiotics and dosing regimens bundled with the treatment algorithm
  - Preloading an automated ED medication dispensing and management system
- Appropriate antibiotic selection for CAP was studied in 2 EDs, comparing rates prior to intervention in 2008 to post-intervention in 2011
  - In the pilot ED, appropriate antibiotic selection for CAP improved from 54.9% to 93.4% (P=0.001)
  - In the second ED, appropriate antibiotic prescribing regimens for CAP improved from 64.6% to 91.3% (P=0.004)

The combination of interdisciplinary teamwork, antibiotic stewardship, education, and information technology was associated with replicable and sustained prescribing improvements

Ostrowsky B et al. Infect Control Hosp Epidemiol. 2013;34(6):566-72

Example #3: Impact of Antimicrobial Stewardship Programs, University of Kentucky (1998-2002)

- Members and institution size:
  - ID physician, ID pharmacist
  - 473 beds
- Interventions:
  - Recommendations regarding antibiotic selection
  - De-escalation of antibiotic therapy on day 3
- Outcomes:
  - Dramatic reduction in antimicrobial expenditures
  - Stabilization of *Pseudomonas aeruginosa* susceptibility

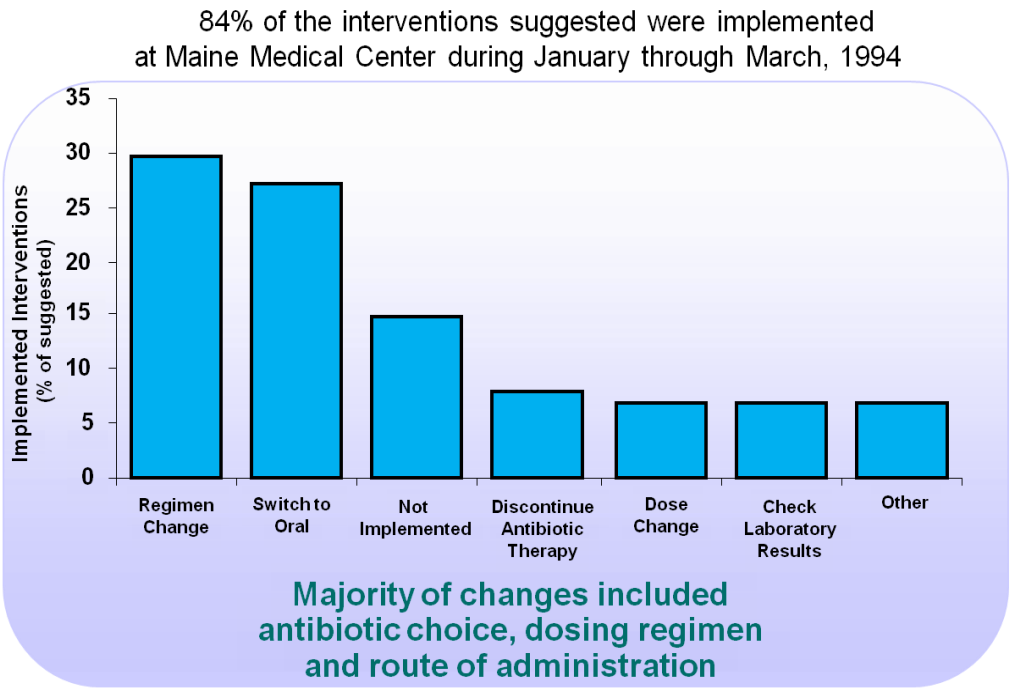


NOTE: This study trended inflation rates to simulate rise in antimicrobial expenditures if the ASP was non-existent

Martin C, et al. *Am J Health-Syst Pharm.* 2005;62:732-738

Example #4: Impact of Antimicrobial Stewardship Programs, Maine Medical Center (2001-2004) [1,2]

- Members and institution
  - ID physician and ID pharmacist
- Interventions
  - Concurrent chart review 3 days per week
  - Targeted patients receiving multiple, prolonged, or high-cost therapies
- Outcomes:
  - At 3 months, antibiotic charges decreased ($1,287, intervention group; $1,674 in control group; $p < 0.04$)
  - At 3 years, monthly antibiotic expenditures had decreased approximately $25,000



1 Fraser GL, et al. *Arch Intern Med.* 1997;157:1689-94.

2 Fraser GL, et al. In: Owens RC, Ambrose PG, Nightingale CH, eds. *Antibiotic Optimization: Concepts and Strategies in Clinical Practice*. New York, NY: Marcel Dekker; 2005:261-326.

Example #5: Program at a Small Community Hospital

- 120-bed community hospital studied in 2000
- Antibiotic support team (AST) – ID MD, PharmD, members of infection control and microbiology
  - ID MD devoted 8-12 hours per week on AST
- Concurrent chart review 3 days per week targeting patients receiving multiple, prolonged, or high-cost antimicrobial therapy
- Results:
  - 488 recommendations; 69% accepted
  - Antibiotic costs reduced 19%; $18.21/pt-day to $14.77/pt-day
  - Total estimated savings of $177,000 in 2000 (vs. 1999)

LaRocca A. Clin Infect Dis. 2003;37:742-3 (letter)

Example #6: Program at a Large Community Hospital

- In a 530-bed community hospital, an ASP team comprised 2 ID physicians and 3 ICU pharmacists
- Prospective audit of new antibiotic starts and weekly use of 8 targeted antimicrobials*; outcomes were compared in the 1-year pre-ASP and 1-year post-ASP periods
- Results:
  - A total of 510 antimicrobial orders were reviewed, of which 323 (63%) were appropriate, 94 (18%) prompted de-escalation, 61 (12%) were denied, and 27 (5%) led to formal consultation with an ID physician
  - There was a 25.4% decrease in defined daily doses of the targeted antimicrobials
  - The ASP was associated with ~50% reduction in the odds of developing *C. difficile* infection (OR 0.46, 95% CI, 0.25-0.82)
  - The ASP was not associated with decreased 30-day mortality after discharge or readmission rate
  - The antimicrobial cost per patient-day decreased by 13.3%, from $10.16 to $8.81, translating to a decreased antimicrobial budget of 15.2%, or $228,911.

* Targeted antimicrobials included aztreonam, caspofungin, daptomycin, ertapenem, linezolid, meropenem, tigecycline, and voriconazole

Malani A et al. Am J Infect Control. 2013;41(2):145-8

Example #7: Telemedicine in a Setting of Limited Resources

- 141-bed rural community hospital
- Antibiotics with potential for overuse and misuse were identified
  - Linezolid, vancomycin, daptomycin, piperacillin/tazobactam, imipenem , and ertapenem
- Stewardship planners included Chief Medical Officer (CMO), Director of Pharmacy, a clinical microbiologist, and infection prevention
- “Mole whackers” included 5 pharmacists (1 with clinical training), 2 PGY1 pharmacy residents, CMO (once weekly)
- Program included teleconferencing capability with a remotely located ID physician contracted by the institution (once weekly)
- Hospital used a drug formulary, but had no prior authorization program or computerized physician order entry; back-end IT was limited

Yam P et al. Am J Health-Syst Pharm. 2012;29:1142-8

Example #7: Telemedicine in a Setting of Limited Resources (cont'd)

- Interventions included audit and feedback:
  - Pharmacist review of new antimicrobial oreders
  - Medication orders triaged for immediate intervention via written form of weekly discussion with CMO
  - Complex cases were elevated to remote weekly discussions with ID physician using telemedicine
- Simultaneously, education was performed using CME sessions for medical staff and ID-focused hospital newsletters, including stewardship certification of the ASP staff
- Outcomes (pre/post):
  - Average number of ASP interventions increased from 2/week to 25/week
  - Streamlining of empiric antibiotic regimens increased from 44% to ~80%
  - Antibiotic purchases decreased from $13,000/1,000 patient-days to $6,300/1,000 patient-days
  - Rates of *C. difficile* infection declined from 8.2 cases/10,000 patient-days to 3.1 cases/10,000 patient-days

Yam P et al. Am J Health-Syst Pharm. 2012;29:1142-8

Example #8: Antimicrobial Stewardship in a Long-Term Acute Care Hospital (LTACH)

- 60-bed LTACH (defined as high-acuity patients requiring long-term care (mean, > 25 days)
- High antimicrobial utilization similar to ICUs: 993 DDD/1,000 patient-days
- Resources:
  - Program planners included ID physician and Director of Pharmacy
  - “Mole whackers” included a pharmacist (no specialty training) and an ID physician (1 hour/week)
  - Limited IT support (no EMR or CPOE)
  - No formulary restrictions or prior authorization

Pate P et al. Infect Control Hosp Epidemiol. 2012:33:405-8

Example #8: Antimicrobial Stewardship in a Long-Term Acute Care Hospital (LTACH) (cont'd)

- Interventions:
  - Pharmacist identified patients for review for a one-hour weekly meeting with ID physician
  - Pharmacist provided recommendations via a non-permanent chart note
- Outcomes (pre/post)
  - Total antimicrobial use decreased 21%, from 993 DDD/1,000PD to 786 DDD/1,000PD
    - Carbapenems decreased 39%
    - Fluoroquinolones decreased 42%
    - Linezolid decreased 58%
    - Metronidazole decreased 31%
  - Antimicrobial costs/patient-day decreased 28% ($29/PD to $20.8/PD)
  - Rate of *C. difficile* infection increased but was not statistically significant (5.1 cases/10,000 pt-days to 11.3 cases/10,000 pt-days, P=0.14)

Pate P et al. Infect Control Hosp Epidemiol. 2012:33:405-8

Example #9: Antimicrobial Stewardship in a Long-Term Care Facility; Keeping a 'LID' on Antibiotic Use

- An infectious disease consultation service (LID) was introduced to provide on-site consultations to residents of a 160-bed Veterans Affairs LTCF
- Systemic antimicrobial use and positive *C. difficile* tests were for the 36 months before and the 18 months after initiation of LID
- Results:
  - Total systemic antibiotic administration decreased by 30% (P<0.001), with significant reductions in both oral (32%; P<0.001) and intravenous (25%; P=0.008) agents
  - The greatest reductions were observed for tetracyclines (64%; P<0.001), clindamycin (61%; P<0.001), trimethoprim/sulfamethoxazole (38%; P<0.001), fluoroquinolones (38%; P<0.001), and beta-lactam/beta-lactamase inhibitor combinations (28%; P<0.001)
  - The rate of positive *C. difficile* tests at the LTCF declined in the post-intervention period relative to the pre-intervention rates (P=0.04)

Implementation of an LTCF ID service led to a signifcant reduction in total antimicrobial use

Jump R et al. Infect Control Hosp Epidemiol. 2012;33(12):1185-92

Example #10: Temporal Effects of a Restrictive Antibiotic Policy

- A restrictive antibiotic policy banned routine use of ceftriaxone and ciprofloxacin following an educational program
- Monthly consumption of 9 antibiotics (DDD/1000 pt-bed days) measured 9 months before until 16 months after policy introduction
- Hospital-acquired *C.difficile*, MRSA and ESBL-producing coliforms were monitored (case/month/1000 pt-bed days)
- Results (between first and final 6 months):
  - Average monthly consumption of ceftriaxone and ciprofloxacin decreased 95% and 73%, respectively
  - *C. difficile* was reduced by 77%, MRSA by 25%, and ESBL-producing coliforms by 17%
  - An audit 3 years after the policy showed sustained reduction in *C.difficile*, MRSA, and ESBL-producing coliform rates

ASP activities have occasionally reported a decrease in bacterial resistance, but this is difficult to achieve and is likely multifactorial; however, the effect of antimicrobial stewardship on *C. difficile* infection rates is well-documented but also relies on many factors.

Dancer J et al. Int J Antimicrob Agents. 2013;41(2):137-42.

The Pitch for Antimicrobial Stewardship Programs: Hospital Administration

- The basic approach
  - If done right, an intervention will save money, improve outcomes, and increase provider satisfaction
  - Identify active issues in your facility
  - Meet with stakeholders (“C” suite), department heads, and other prescribers to assess their needs
  - Are there opportunities for reduction in LOS?
- Emphasize “low-hanging fruit” initially – results can be observed in the short-term and allow sufficient time to study what issues constitute “high-hanging fruit”
  - Estimate cost-savings on expensive agents (e.g., linezolid, daptomycin, echinocandins, carbapenems, aztreonam, tigecycline) but not necessarily the workhorse antibiotic
  - Include cost-savings from antibiotic redundancy and improved contracting
  - IV-to-PO switch, especially fluoroquinolones, voriconazole and linezolid

The Pitch for Antimicrobial Stewardship Programs: Hospital Administration (cont'd)

- Use evidence from other institutions (reduced antibiotic budget, reduction in *C. difficile* infection, improved patient-level outcomes, decreased ICU or total LOS, improved antibiotic use, safety)
- Be synchronous with the goals of hospital administration; what are administrators interested in – what are their issues?
  - Decrease and control costs
  - Improve regulatory compliance (IPPS, core measures)
  - Remain competitive with surrounding institutions, including public reporting and patient surveys
  - Optimize patient safety, especially if it decreases costs
- Can bacterial resistance be decreased?? Not in the short-term, so do not promise upfront (use to justify ASP later, if this is observed – take credit for it)
- Pick a clinical syndrome with evidence-based management guidelines as a second phase, unless you are confident that a clinical change can occur within the first phase

Stewardship Case for Pharmacy Administration

- Review antibiotic formulary and what is on the shelves – look for redundant agents and “clear the shelves”; implement therapeutic substitution[1]
  - Assess the need for multiple echinocandins
  - Does Pharmacy need to stock both ceftazidime and cefepime?
- Work with purchasing agent – are there contracting opportunities?
- Batching of intravenous antimicrobials, such as caspofungin and daptomycin[1]
- Analyze pharmacy workflow in compounding agents
- Study the root causes of delayed administration of antimicrobials
- Assess the availability of antimicrobials in automated dispensing machines
  - Can some agents be packaged differently with instructions for reconstitution?
  - Should certain items be packaged with treatment guidelines, such as a “CAP kit”
- Improve regulatory compliance and performance measures, such as SCIP

Winning over hospital administration means winning over Pharmacy Directors too, but there are additional activities which are Pharmacy-department specific

1 Goff D et al. Clin Infect Dis. 2012;55(4):587-92.

The Pitch for Antimicrobial Stewardship Programs: Prescribers

- Address what prescribers need:
  - Optimize patient safety – difficult to argue against
  - Regulatory compliance, such as surgery; sometimes compelling
  - Potential to reduce resistance
  - What reports and interactions do they need? Data monitoring and transparency
- Do not emphasize control of costs – you do not want to be perceived as the "antibiotic cop"
- Communication skills are essential
  - The ASP is not telling them what to do; it is trying to make their lives easier!! (Antibiotic selection and management are actually very complex activities!)
  - Anecdotes can be compelling, especially if they are from institutional experiences
- Education can be a carrot – what reports and interactions do they need?
  - "Do you know about the most recent endocarditis prophylaxis guidelines? Let me give you a quick summary."

The Pitch for Antimicrobial Stewardship Programs: Prescribers (cont'd)

- Antimicrobial stewardship will help them take better care of patients:
  - Guide therapy for complex patients and resistant infections
  - De-escalation of antibiotics optimize therapy
  - Guide dosing in patients with renal/hepatic dysfunction
  - IV to PO switch for earlier discharge
  - Decrease unintended consequences of antimicrobial use, e.g., *Clostridium difficile* infections
  - Prevent adverse events, e.g., drug-drug and drug-disease interactions
  - Guide drug selection in patients with multiple allergies
  - Improve drug compliance and education at discharge
  - Improve transition of care
- Recruit thought leaders in different specialties to support and reiterate your message
  - The peer champion perspective is powerful
  - Nurses work well in the right setting since they are the direct caregiver

ADDITIONAL SLIDES

Example:
Guideline-Concordant Therapy in CAP

- 54,619 patients (non-ICU) hospitalized for CAP at 113 community hospitals
- 65% received initial guideline-concordant therapy

Measure	Guideline-Concordant Therapy (vs Non-Concordant Therapy)	Significance
In-hospital mortality	Odds ratio =0.70	95% CI, 0.63-0.77
Sepsis	Odds ratio =0.83	95% CI, 0.72-0.96
Renal failure	Odds ratio =0.79	95% CI, 0.67-0.94
Length of stay	Decreased 0.6 days	P<0.001
Duration of IV therapy	Decreased 0.6 days	P<0.001

An ASP structured to strengthen compliance with treatment guidelines may impact patient outcomes and length of stay

McCabe C et al. Arch Int Med. 2009;169(16):1525-31

Example: Reduction in Broad-Spectrum Antimicrobial Use

- A 4-year program in a 731-bed tertiary-care teaching hospital
- Review of charts 48 hours after prescribing broad-spectrum antibiotics (antibacterials + anti-fungals)
- Recommendation (written) to streamline or D/C
  - Automatic implementation of recommendation if no response within 24 hours by attending/resident
- Results (changes to regimens after 3rd day):
  - 92% complete or partial acceptance of recommendation
  - 27% reduction in broad-spectrum antibiotics
  - 20% decrease in monthly costs ($340,591 in 2000 to $274,030 in 2003)
  - Interventions did not alter antibiotic susceptibility rates over 4 years of program

Cook PP et al. *J Antimicrob Chemother.* 2004;53:853-9

Example: A Controlled Trial of a Critical Pathway for Treatment of Community-Acquired Pneumonia

Parameter	Critical Pathway	Conventional
LOS, median	5.0 days	6.7 days
LOS, average	8.2 days	9.6 days
Duration IV antibiotics, mean	4.6 days	6.3 days
% Patients receiving monotx	64%	27%
BDPM (# bed days per patient managed)	4.4 days	6.1 days
Reduction in CAP admission rate	18%	---

19 Canadian centers; 1,743 CAP patients during 7-month 1998 study period

Critical pathway (9 centers) = clinical prediction rule for admission decision (Fine score) + levofloxacin therapy (500mg IV/PO x 10 days) + practice guidelines (criteria-based practice guidelines for IV to PO switch and discharge, assessment by study RN, chart notes recommending IV to PO switch and hospital discharge)

Reduction of BDPM by 1.7 days = $1,700 (U.S.) saved per patient treated

Critical pathway and conventional sites showed similar QOL scores and adverse clinical outcomes (ICU admission, mortality, readmissions, complications, any adverse outcome)

Marrie T et al. JAMA. 2000;283(6):749-55.